AMENDMENTS TO THE CLAIMS

Claim 1 (Currently Amended): A titanium alloy member ~~characterized in that: it comprises~~ comprising

40% by weight or more of titanium (Ti),

a IVa group element other than titanium as a first substitutional element, ~~and /or~~

a Va group element ~~other than the titanium~~ as a second substitutional element, ~~wherein a summed amount including the IVa group element and /or the Va group element as well as the titanium is 90% by weight or more,~~ and

0.25 to 2.0% by weight of one or more interstitial elements ~~of an interstitial element~~ selected from the group ~~, consisting~~ consisting of oxygen (O), nitrogen (N) and carbon (C), ~~in a summed amount of from 0.25 to 2.0% by weight, in a total amount of 100% by weight, and having a specific~~ wherein

the titanium alloy member contains a summed amount of the Va group element, the IVa group element other than titanium, and the titanium of 90% by weight or more;

the titanium alloy member has a composition in which

a compositional mean value of the substitutional elements is $2.43 < Md < 2.49$ with regard to the energy level "Md" of the d-electron orbit and

a compositional mean value of the substitutional elements is $2.86 < Bo < 2.90$ with regard to the bond order "Bo", where the "Md" and the "Bo" are each ~~being~~ a parameter obtained by the "DV-X α" cluster method;

~~it~~ the titanium alloy member comprises grains ~~which are~~ having a body-centered tetragonal ~~crystal~~ or a body-centered cubic crystal structure, in which a ratio (c/a) of a

distance between atoms on the c-axis with respect to a distance between atoms on the a-axis falls in a range of from 0.9 to 1.1; ~~and~~

~~it~~ the titanium alloy member has a ~~texture,~~ texture such that, when a polar figure of the (110) or (101) crystal plane of the grains is measured ~~parallelly~~ parallel to ~~a plane, which involves~~ a working direction, in ranges of $20° < \alpha' < 90°$ and $0° < \beta < 360°$ by the ~~Schlutz's~~ Schulz reflection method, ~~and when the respective measurement values (X), which distribute equally on the polar figure, are processed statistically, texture in which a value~~

$(\nu 2/Xm^2)$ ~~, which is obtained by dividing a secondary moment (ν 2) around a mean value (Xm), being defined by the following equation, with a square of the mean value (Xm^2),~~ is 0.3 or more, ~~a value~~ and

$(\nu 3/Xm^3)$ ~~, which is obtained by dividing a tertiary moment (ν 3) around the mean value (Xm), being defined by the following equation, with a cube of the mean value (Xm^3),~~ is 0.3 or more, ~~and values (1.6Xm), which are 1.6 times or more of the mean value, are further involved in measurement values, which are measured in a range of 55° < α ' < 65° and in the range of β along the working direction; Secondary Moment:~~ where

$\nu 2 = \{\Sigma (X-Xm)^2\}/N$, ~~Tertiary Moment:~~

$\nu 3 = \{\Sigma (X-Xm)^3\}/N$ ~~wherein N is a number of samplings~~ , and

Xm is the mean value of N measurement values X; and

the titanium alloy member has a tensile deformation property such that a gradient of the tangential line in a stress-strain diagram obtained by a tensile test within an elastic deformation range, in which the stress ranges from 0 to the tensile elastic limit strength, decreases continuously with increase in stress.

Claim 2 (Previously Presented): The titanium alloy member set forth in claim 1, exhibiting a dislocation density of $10^{11}/cm^2$ or less when cold working is carried out by 50% or more.

Claim 3 (Currently Amended): The titanium alloy member set forth in claim 1, including the one or more interstitial elements ~~of said interstitial element group~~ in a summed amount of from 0.6 to 1.5% by weight.

Claim 4 (Currently Amended): A process for ~~producing~~ making a titanium alloy member ~~set forth in claim 1~~, the process comprising:

preparing a raw material ~~, the raw material comprising said specific composition~~; ~~and~~

~~member forming step of~~ forming ~~a titanium alloy member comprising~~ the raw material ~~after the preparing step and having said texture~~; and

producing the titanium alloy member of Claim 1.

Claim 5 (Currently Amended): The process ~~for producing a titanium alloy member~~ set forth in claim 4, wherein ~~said preparing step is a powder preparing step in which a~~

the raw material comprises a powder ~~for making the specific composition is prepared~~; and

~~said member~~ the forming ~~step further~~ comprises ~~a sintering step in which a sintered member is manufactured from~~ sintering the raw material ~~powder after the powder preparing step~~.

Claim 6 (Currently Amended): The process ~~for producing a titanium alloy member~~ set forth in claim 4, ~~wherein said member forming step~~ further ~~comprises an ingot manufacturing step in which~~ comprising manufacturing an ingot ~~member is manufactured~~ from ~~said~~ the raw material ~~after said preparing step~~.

Claim 7 (Currently Amended): The process ~~for producing a titanium alloy member~~ set forth in claim 5 ~~or 6~~, further ~~comprising a~~ comprising cold-working ~~step in which said~~ the sintered ~~member or ingot member is cold-worked~~ raw material.

Claim 8 (Currently Amended): The process ~~for producing a titanium alloy member~~ set forth in claim 7, wherein ~~said~~ in the cold-working ~~step is a step in which~~ a cold-working ratio is 10% or more; and

the process further comprises ~~an age-treatment step, in which age-treatment is carried out~~ age-treating the cold-worked material so that the Larson·Miller parameter ~~"P" (hereinafter simply referred to as the parameter "P")~~ P falls in a range of from 8.0 to 18.5 at a treatment temperature falling in a range of from 150°C to 600°C ~~, after said cold-working step~~.

Claim 9 (Currently Amended): The process ~~for producing a titanium alloy member~~ set forth in claim 8, wherein ~~said age-treatment step is a step in which said parameter "P"~~ P falls in a range of from 8.0 to 12.0 ~~at said~~ and the treatment temperature ~~falling~~ falls in a range of from 150°C to 300°C; and

the titanium alloy member obtained after the ~~age-treatment step~~ age-treating has a tensile elastic strength of 1,000 MPa or more, an elastic deformation capability of 2.0% or more and a mean Young's modulus of 75 GPa or less.

Claim 10 (Currently Amended): The process ~~for producing a titanium alloy member~~ set forth in claim 8, wherein ~~said age-treatment step is a step in which said parameter "P"~~ P falls in a range of from 12.0 to 14.5 ~~at said~~ and the treatment temperature ~~falling~~ falls in a range of from 300°C to 600°C; and

the titanium alloy member obtained after the ~~age-treatment step~~ age-treating has a tensile elastic strength of 1,400 MPa or more, an elastic deformation capability of 1.6% or more and a mean Young's modulus of 95 GPa or less.

Claims 11-14 (Canceled).

Claim 15 (New): The process set forth in claim 6, further comprising cold-working the ingot.

Claim 16 (New): The process set forth in claim 15, wherein in the cold-working a cold-working ratio is 10% or more; and

the process further comprises age-treating the cold-worked material so that the Larson·Miller parameter P falls in a range of from 8.0 to 18.5 at a treatment temperature falling in a range of from 150℃ to 600°C.

Claim 17 (New): The process set forth in claim 16, wherein P falls in a range of from 8.0 to 12.0 and the treatment temperature falls in a range of from 150°C to 300°C; and

the titanium alloy member obtained after the age-treating has a tensile elastic strength of 1,000 MPa or more, an elastic deformation capability of 2.0% or more and a mean Young's modulus of 75 GPa or less.

Claim 18 (New): The process set forth in claim 16, wherein P falls in a range of from 12.0 to 14.5 and the treatment temperature falls in a range of from 300°C to 600°C; and

the titanium alloy member obtained after the age-treating has a tensile elastic strength of 1,400 MPa or more, an elastic deformation capability of 1.6% or more and a mean Young's modulus of 95 GPa or less.

SUPPORT FOR THE AMENDMENT

This Amendment amends the specification; rewrites the Abstract as a single paragraph; amends Claims 1, 3-10; and adds new Claims 16-18. Support for the amendments is found in the specification and claims as originally filed. In particular, support for amending the specification by replacing "interstitial (alloying) elements" with --substitutional elements-- is found in Claim 1 and in the specification at least at page 6, paragraph [0019]; page 8, paragraph [0027]; page 15, paragraphs [0063] and [0064]; and page 18, paragraph [0076] (The skilled artisan recognizes that Nb, Ta, V, Zr and Hf are substitutional elements in Ti alloys, not interstitial elements such as O, N and C). Support for Claim 1 is found in the specification at least at page 6, paragraph [0019] ("substitutional elements"). "Schlutz's reflection method" is replaced with --Schluz reflection method-- to correct a typographical error (see, e.g., <u>Elements of X-ray Diffrraction, 2d edition</u>, pages 308-316, copy attached). Additional support for Claim 1 is found in the specification at least at page 23-26 and in FIG. 14A (Gradient (i.e., slope) of tangent to stress-strain curve decreases continuously along stress-strain curve with increase in stress from 0). Support for new Claim 15 is found at least in Claim 7. Support for new Claim 16 is found at least in Claim 8. Support for new Claim 17 is found at least in Claim 9. Support for new Claim 18 is found at least in Claim 10. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-10 and 15-18 will be pending in this application. Claim 1 is independent.

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

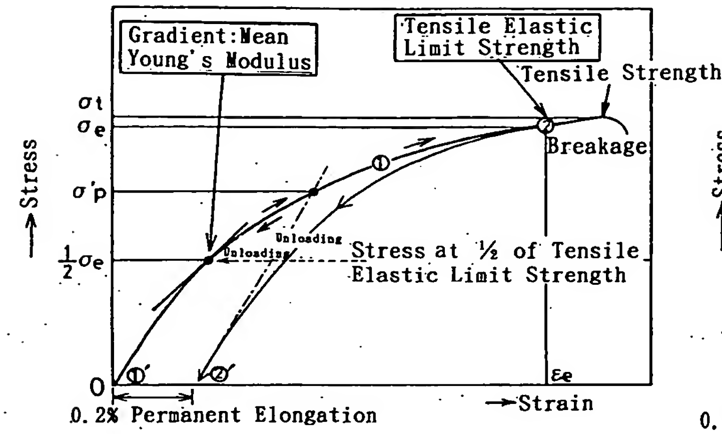
Applicants thank the Examiner for the courtesies extended to their representative during the November 6, 2003, personal interview.

As discussed at the interview, the present invention provides a titanium alloy member with superior cold working properties, a low Young's modulus and high strength. The titanium alloy of the present invention includes an unprecedented large amount of O, N or C, is remarkably tough and shows a high elastic deformation capability. "This discovery is epoch-making in the industrial field of titanium alloy". Specification at page 14, lines 2-3. As a result of the present invention, the necessity for strictly controlling the oxygen content in titanium alloys has been obviated. Specification at page 14, lines 7-9.

The titanium alloy member of the present invention has a texture such that, when a polar figure of the (110) or (101) crystal plane of the grains is measured parallel to a working direction, in ranges of $20° < \alpha' < 90°$ and $0° < \beta < 360°$ by the Schulz reflection method, ($\nu 2/Xm^2$) is 0.3 or more, and ($\nu 3/Xm^3$) is 0.3 or more, where $\nu 2 = \{\Sigma\ (X-Xm)^2\}/N$, $\nu 3 = \{\Sigma\ (X-Xm)^3\}/N$, and Xm is the mean value of N measurement values of diffracted X-ray beam intensity X.

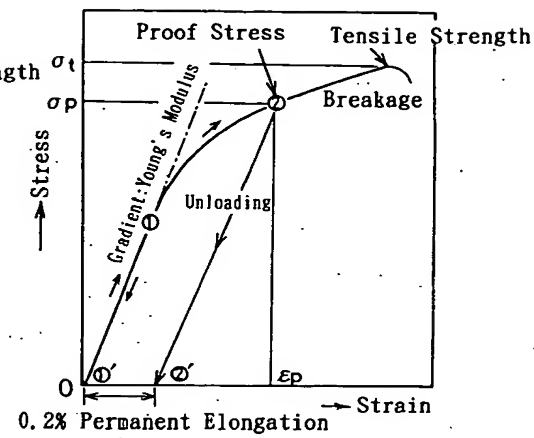
Qualitative differences in the stress-strain curve of the titanium alloy member of the present invention and the stress-strain curve of conventional titanium alloy are shown in the specification at Figs. 14A and 14B, which are reproduced below.

FIG. 14A



Titanium Alloy of Present Invention

FIG. 14B



Conventional Titanium Alloy

While conventional titanium alloys are characterized by a tensile strength, σt, the inventive titanium alloy member is characterized by a "tensile elastic limit strength", σe, which is less than σt.

In contrast to conventional titanium alloy, the titanium alloy member of the present invention has a stress-strain curve that is not linear in the low strain, elastic deformation range, but instead has a gradient (i.e., slope) that continuously decreases along the stress-strain curve with increasing strain.

Claims 1-10 are rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,871,595 ("Ahmed"). Ahmed discloses a conventional titanium alloy that lacks the inventive combination of low Young's modulus, high elastic deformation and high strength. Ahmed's conventional titanium alloy has a stress-strain curve that is linear at low strain.

The attached Declaration Under 37 C.F.R. § 1.132 shows that Ahmed's TA22 (Ti-35.3 Nb-4.9 Ta-7.2 Zr) alloy has a tensile strength of 590 MPa, a tensile elastic limit-strength (0.2% per stress) of 530 MPa, a Young's modulus of 55 GPa, and an elastic deformation of approximately 1%. Furthermore, up to approximately 0.7% strain, the stress-strain curve for Ahmed's TA 22 alloy remains linear (no deviation from a straight line). Declaration at 37 C.F.R. § 1.132 at sections 5-7; Figs. A-B.

However, Ahmed fails to suggest the titanium alloy member of independent Claim 1 which "has a tensile deformation property such that a gradient of the tangential line in a stress-strain diagram obtained by a tensile test within an elastic deformation range, in which the stress ranges from 0 to the tensile elastic limit strength, decreases continuously with increase in stress".

Because Ahmed fails to suggest all the limitations of independent Claim 1, the rejection over Ahmed should be withdrawn.

The abstract of the disclosure is objected to. To obviate the objection, the abstract is rewritten as a single paragraph.

Claims 1-10 are rejected under 35 U.S.C. § 112, second paragraph. To obviate the rejection, the claims are amended.

Pursuant to M.P.E.P. § 821.04, after independent Claim 1 is allowed, Applicants respectfully request examination and allowance of method Claims 4-10 and 15-18, which include all the limitations of independent product Claim 1.

In view of the foregoing amendment and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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Attachments:

<u>Elements of X-ray Diffraction, 2d edition</u>, pages 308-316
Declaration Under 37 C.F.R. § 1.132

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